

CLAIMS:

1. An apparatus for producing a patterned material comprising:
an external land die for extruding a material;
5 a patterned roller in close proximity to said external land die.
2. An apparatus as in claim 1 wherein said patterned roller is mounted on the gimbals.
10
3. An apparatus as in claim 2 wherein said patterned roller is constrained to allow rotation on two axes with respect to said external land die.
4. An apparatus as in claim 1 wherein said patterned roller is
15 mounted for rotation.
5. An apparatus as in claim 1 wherein a distance between said external land die and said patterned roller is adjustable.
- 20 6. An apparatus as in claim 1 wherein said patterned roller is heated.
7. An apparatus as in claim 1 wherein said external land die comprises:
25 a first external land surface; and
a second external land surface.
8. An apparatus as in claim 7 wherein said first external land surface and said second external land surface form a trapezoid with respect to a
30 surface of said patterned roller.
9. An apparatus as in claim 7 wherein:

said first external land surface creates a diverging region with respect to a direction of rotation of said patterned roller; and

said second external land surface creates a converging region with respect to said direction of rotation of said patterned roller.

5

10. An apparatus as in claim 9 wherein a first hydrodynamic pressure created in said diverging region is less than a second hydrodynamic pressure created in said converging region.

10

11. An apparatus as in claim 10 wherein said second hydrodynamic pressure is in excess of 1.01×10^6 Pa to compress entrapped air in said material.

15

12. An apparatus as in claim 9 wherein the rate of pressure change in the converging region is at least 1.5×10^7 Pa/s.

20

13. An apparatus as in claim 7 wherein:
a first heater heats said first external land surface; and
a second heater heats said second external land surface.

25

14. An apparatus as in claim 13 wherein said first heater operates at a different temperature than said second heater.

30

15. An apparatus as in claim 1 comprising:
a first end seal at a first end of said external land die;
a second end seal at a second end of said external land die;
and
wherein said first end seal and said second end seal prevent said material from leaking past said first and second end of said external land die.

30

16. An apparatus as in claim 1 wherein said patterned roller is vented.

17. An apparatus as in claim 1 wherein said extruded material is molten.
- 5 18. An apparatus as in claim 1 wherein said material is comprised of at least two separate materials for coextruding at least two separate layers.
- 10 19. An apparatus as in claim 1 wherein said material is a polymer.
20. An apparatus as in claim 1 wherein said material is a low curtain strength material.
- 15 21. An apparatus for producing a patterned material comprising:
- an external land die for extruding a material;
a patterned roller in close proximity to said external land die;
- 20 wherein said patterned roller is mounted on gimbals;
wherein said patterned roller is mounted for rotation; and
wherein a distance between said external land die and said patterned roller is adjustable.
- 25 22. An apparatus as in claim 21 wherein said patterned roller is heated.
- 30 23. An apparatus as in claim 21 wherein said external land die comprises:
- a first external land surface; and
a second external land surface.

24. An apparatus as in claim 23 wherein said first external land surface and said second external land surface form a trapezoid with respect to a surface of said patterned roller.

5 25. An apparatus as in claim 23 wherein:
 said first external land surface creates a diverging region
with respect to a direction of rotation of said patterned roller; and
 said second external land surface creates a converging
region with respect to said direction of rotation of said patterned roller.

10

26. An apparatus as in claim 25 wherein a first hydrodynamic pressure created in said diverging region is less than a second hydrodynamic pressure created in said converging region.

15

27. An apparatus as in claim 26 wherein said second hydrodynamic pressure is in excess of 1.01×10^6 Pa to compress entrapped air in said material.

20

28. An apparatus as in claim 23 wherein:
a first heater heats said first external land surface; and
a second heater heats said second external land surface.

25

29. An apparatus as in claim 21 wherein said pattern roller has a depth of at least 6 microns.

30. An apparatus as in claim 28 wherein said first heater operates at a different temperature than said second heater.

30

31. An apparatus as in claim 21 comprising:
a first end seal at a first end of said external land die;
a second end seal at a second end of said external land die;
and

wherein said first end seal and said second end seal prevent said material from leaking past said first and second end of said external land die.

5 32. An external land die for extruding a material comprising:
 a first external land surface;
 a second external land surface; and
 wherein said first external land surface and said second
external land surface form a trapezoid with respect to a surface of a patterned
roller.

10

 33. An apparatus as in claim 32 wherein:
 said first external land surface creates a diverging region
with respect to a direction of rotation of said patterned roller; and
 said second external land surface creates a converging
15 region with respect to said direction of rotation of said patterned roller.

 34. An apparatus as in claim 33 wherein a first hydrodynamic
pressure created in said diverging region is less than a second hydrodynamic
pressure created in said converging region.

20

 35. An apparatus as in claim 34 wherein said second
hydrodynamic pressure is in excess of 10 atmospheres to compress entrapped air
in said material.

25 36. An apparatus as in claim 33 wherein:
 a first heater heats said first external land surface; and
 a second heater heats said second external land surface.

 37. An apparatus as in claim 36 wherein said first heater
30 operates at a different temperature than said second heater.

38. A method for producing a patterned web comprising the steps of:
- 5 heating a material which comprises said web;
pumping said material into a cavity at a controlled rate;
distributing said material over a length of a slot;
forcing said material into a cavity formed by a first external land surface, a second external land surface and a surface of a patterned roller; and partially solidifying said material under high-pressure.
- 10 39. A method as in claim 38 further comprising:
continuing solidification of said material on said patterned roller after it exits said cavity.
- 15 40. A method as in claim 38 wherein said web is stripped from said patterned roller.
41. An apparatus for producing an extruded material comprising:
- 20 an external land die for extruding said material;
a roller in close proximity to said external land die;
wherein said roller is mounted on gimbals;
wherein said roller is mounted for rotation; and
wherein a distance between said external land die and said roller is adjustable.